

D. Remarks

The claims are 1-7, with claim 1 being the sole independent claim. Claim 1 has been amended to clarify the present invention. Support for this amendment may be found, inter alia, in the specification on pages 14-18 and in Figs. 2A-2C. Claims 3-7 have been amended to reflect the changes in claim 1. No new matter has been added.

Reconsideration of the present claims is expressly requested.

Claims 1-4 and 7 stand rejected under 35 U.S.C. § 102(b) as being allegedly anticipated by U.S. Patent No. 5,992,974 (Miyata). Claims 5 and 6 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Miyata. These rejections are respectfully traversed.

Prior to addressing the merits of rejection, Applicant would like to briefly review some of the key features of the presently claimed invention. The present invention is directed to a method of manufacturing a liquid jet recording head. In this method, an anisotropic-etching mask is formed on a nozzle surface of the top plate. Then, this mask is patterned to form a compensation pattern, which extends over a portion of the top plate, which is later removed to form the liquid chamber.

The top plate is anisotropically etched using the compensation pattern as a mask. The etching is conducted so that the top plate is over-etched, i.e., in addition to the portion of the top plate not covered (not masked) with the compensation pattern, a portion of the top plate under the compensation pattern (masked by the compensation pattern) is also removed while the compensation pattern is still present. For example, amended Fig.

2B shows an example of the back side of the wafer, and over-etching under the compensation patterns can be clearly seen.

For the Examiner's convenience, Applicant hereby again provides an example of presently claimed method with specific emphasis on some of the above-mentioned key features. Applicant notes that this method is merely an example and does not limit the claimed invention.¹

Initially, a SiO₂ layer is formed on a front and a back surface of the silicon wafer 5 (page 14, line 23 - page 15, line 8). The back surface is then patterned into a shape of the nozzles and the liquid chamber. The front surface is patterned into a shape of the liquid chamber, and the patterning shape on the front surface is a comb shape (compensation pattern) (page 15, line 8 - page 16, line 10). The SiO₂ layer on the back surface of the wafer is coated with a SiN layer 7. This SiN is then patterned into a comb shape. Thus, comb-shaped compensation patterns are formed opposite each other on the front and the back surface of the silicon wafer 5.

Then, the etching process is commenced. The entire silicon wafer 5 is simmered in an etchant, and the silicon exposed by the comb-shaped compensation patterns on both the front and the back surface is anisotropically etched (page 16, lines 11-18). Since the SiO₂ layer and the SiN layer are not etched by the etchant used to etch the wafer, the wafer is over-etched such that a portion of the wafer still covered with the compensation patterns is removed. Then, the SiN layer on the back surface is removed by etching after anisotropic etching is completed. Thus, a comb-shaped compensation pattern

¹/Figs. 2A-C illustrate a process in which the silicon wafer is over-etched inside of the compensation pattern while in transition from a state depicted in Fig. 1E' to the one shown in Fig. 1F', and the liquid chamber having a desired shape is formed.

is removed from the silicon wafer, and the nozzle pattern on the SiO₂ layer 6 on the back surface is exposed.

The nozzles are then formed on the silicon wafer 5 by anisotropic etching (page 18, line 22 - page 19, line 2). Lastly, the compensation pattern or the entire SiO₂ layer is removed by spraying air at a high pressure (page 19, lines 20-25).

Miyata is directed to an ink-jet head having nozzle openings through which ink droplets are discharged. In a telephonic interview conducted subsequent to the issuance of the final Office Action, the Examiner alleged that the compensation pattern (mask) in Miyata is represented by reference number 41', which is used as a mask to etch the silicon substrate. Applicant respectfully disagrees.

In order for the silicon dioxide mask layer 41' in Miyata to be a compensation pattern as present claimed, the following conditions must be met:

(i) layer 41' must be formed over a portion of the substrate 40, which is removed to form a chamber for storing liquid;

(ii) substrate 40 must be anisotropically etched using layer 41' as a mask, so that a portion of the substrate under layer 41' is etched away while this portion is still covered with layer 41'.

Applicant respectfully submits that neither of these conditions is met in Miyata. Specifically, layer 41' is formed over supply ports 4 and over what eventually becomes an interface between the substrate 40 and nozzle plate 6. Neither the interface nor the supply ports can be considered to be a chamber for storing liquid. Furthermore, the substrate under layer 41' is not etched until layer 41' is removed (see Figs. 5(e)-5(h)), i.e., there is no etching of the substrate under the mask while the mask is still present.

Therefore, clearly, layer 41' is not a compensation pattern as presently claimed. Furthermore, Applicant respectfully submits that Miyata does not disclose or suggest the presently claimed compensation pattern. Miyata fails to disclose forming a compensation pattern mask over a portion of the top plate, which is later removed to form a liquid chamber for storing liquid, and anisotropically etching the top plate to remove a portion of the top plate under the compensation pattern mask while the compensation pattern is still present.

Accordingly, it is clear that the presently claimed invention is patentable over Miyata. Wherefore, Applicant respectfully requests that the outstanding rejections be withdrawn and that the present case be passed to issue.

This Amendment After Final Rejection should be entered, because it places the case in allowable form. Alternatively, this Amendment places the case in better form for possible appeal.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address given below.

Respectfully submitted,



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